Chapter Three

Core Depot-Level Maintenance

The Department of Defense's policy for depot-level maintenance in the post-Cold War period calls on the services to maintain a minimum "core" of capabilities in the public depots. The Deputy Secretary of Defense outlined that position in a May 1994 memorandum: "CORE is the capability maintained within organic Defense depots to meet readiness and sustainability requirements of the weapon systems that support the JCS [Joint Chiefs of Staff] contingency scenario(s). Core depot maintenance capabilities will comprise only the minimum facilities, equipment, and skilled personnel necessary to ensure a ready and controlled source of required technical competence."[1]

That new DoD dictum echoes the department's Cold War policies. The only conceptual difference is that the new policy places less emphasis on handling a surge in maintenance during mobilization and more weight on having a "controlled source" to ensure readiness. Today, "Core exists to minimize operational risks and to guarantee required readiness for these weapon systems [that is, the systems required in the JCS scenario]."[2] Although repair facilities no longer need to be able to gear up quickly to meet the demands of a broad, sustained conflict, DoD continues to assume that it would be too risky to use contractor support to maintain the frontline weapon systems required by the JCS's plans. That assumption allows DoD to base the core capabilities that its depots will maintain solely on JCS requirements. Missing from that equation are the capabilities of the private sector, the relative costs of public and private production, and the degree of difficulty in administering and monitoring contracts for different kinds of maintenance.

What Is the OSD Core Method?

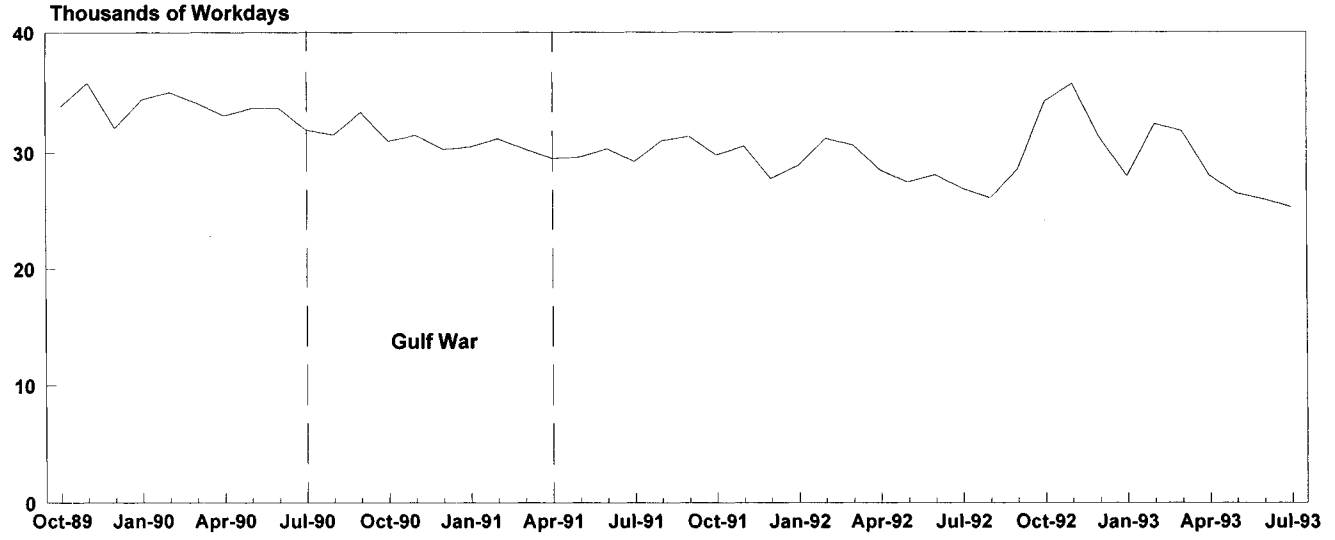
Critics point out that DoD's notion of core capabilities is extremely vague and somewhat tautological. (Since core capabilities are those that are kept within the DoD depots, any that are not kept there are by definition noncore.) To give the core policy an operational content, the Office of the Secretary of Defense outlined a multistep method for determining core capabilities. That method requires the services to identify the number and types of systems called for by the JCS scenario, compute depot-level maintenance requirements (measured in labor hours by type of skill) for those systems based on the scenario, and determine what size labor force would be needed (working on a wartime schedule) to get the work done. The number of hours of maintenance that the labor force would provide when working on a peacetime schedule is known as the peacetime core requirement.

The OSD method allows a service to add hours to its basic peacetime core requirement to ensure a cost-effective scale of operations for particular tasks. In addition, a service can maintain more than its basic peacetime core requirement to perform maintenance

1. Memorandum from John Deutch, Deputy Secretary of Defense, to the Secretaries of the Military Departments and others, May 4, 1994.

2. Memorandum from James R. Klugh, Deputy Under Secretary of Defense for Logistics, to the Secretaries of the Military Departments and others, November 15, 1993.

Figure 3.
Workload in Navy Shipyards, October 1989 to July 1993 (In direct labor workdays)



SOURCE: Congressional Budget Office based on data from the Navy used in John D. Keenan and others, *Issues Concerning Public and Private Provision of Depot Maintenance*, CRM 94-65 (Alexandria, Va.: Center for Naval Analyses, April 1994).

jobs won in public/private competitions, to handle a workload for which there is no private source, or to support a reserve (provided that the reserve can be rationally justified).

Formally, "core" refers to skills and capabilities rather than to specific weapon systems or workloads. As a result, not all of the peacetime maintenance associated with the equipment used in the JCS scenario has to be kept in the public depots. Individual program managers within the services make decisions about what peacetime workloads will go to the public depots to maintain core capabilities; they make those allocations system by system using a decision-tree analysis. DoD plans to develop procedures to ensure that those individual decisions are consistent with total core requirements.

How Do the Services Apply the Core Method?

Each service (with the Naval Sea Systems and Naval Air Systems Commands working separately) has tried to apply the OSD method to determine its peacetime core requirement. A review of those efforts indicates that OSD failed in its attempt to ensure a consistent interpretation of the core concept: the services each applied the method in quite different ways. Moreover, although each service's estimate of its core requirement appears to justify a large role for public depots, a close look at those estimates highlights some fundamental problems with the concept of core capabilities.

Sea Systems

The Naval Sea Systems Command (NAVSEA) provides a clear, well-documented description of its preliminary core calculations.[3] NAVSEA assumes that maintenance in Navy shipyards will drop off sharply during regional conflicts because the ships that are deployed will not be available for their scheduled maintenance. That assumption is consistent with the Navy's experience in the Gulf War (see Figure 3). A large part of the work that Navy shipyards performed during that conflict was on submarines that did not have to be deployed. Based on that experience,

3. Naval Sea Systems Command, Navy Shipyard and Supship and Field Activity Support Directorate, *Report of Naval Shipyard Core* (January 26, 1994). This document provides preliminary estimates that are subject to revision.

NAVSEA has concluded that "the requirement to surge resources to increase capacity in time of war is overall, minimal."[4]

Instead, NAVSEA anticipates only a brief surge in activity at the onset of the first regional conflict. That work would serve to deploy the ships that were in shipyards with their maintenance nearly complete and to position battle-damage teams in the war theater. Depot-level maintenance would reach its peak once both conflicts were over.

To calculate its core requirement, NAVSEA characterized each class of ship by its level of risk. A class was considered high risk if the private sector could not ensure competition for those ships' maintenance, if the number of ships required for the JCS scenario was close to the number in the fleet, or if maintenance for the ships required capabilities that were primarily available in Navy shipyards.[5] The command determined its basic core requirement by allocating the peacetime workload for high- and medium-risk ships to public and private shipyards based on their current capacity for doing the work--with the caveat that Navy shipyards would handle most of the high-risk ships and at least some medium-risk ships. NAVSEA included modifications, which are typically done as part of ship overhauls, in that peacetime workload. It allocated low-risk ships, which include frigates and auxiliary vessels, to the private sector.

NAVSEA focused on allocating its peacetime workload to the public and private sectors because it does not plan on a significant surge in maintenance during wartime. (Nonetheless, it satisfied the letter of the OSD method by assuming that over the two-year period following the conflicts, the surge in maintenance on ships used in the JCS scenario could be handled by increasing the hours worked by the shipyard employees who normally maintained those ships.)

NAVSEA's approach produced a basic core requirement of 26 million direct labor hours per year. (Direct labor hours are those that DoD can attribute to specific workloads. Indirect labor hours, in contrast, are an overhead cost that cannot be attributed to specific workloads.) To its basic core requirement NAVSEA added 6 million hours of its low-risk workload for purposes of "cost control"--that is, to help spread the overhead of the current depot structure over a broader base. It also added 7 million hours for inactivations of nuclear ships, which brought its total core requirement to 40 million direct labor hours for 1999. NAVSEA estimates that this requirement will equal roughly 60 percent of its total 1999 depot-level maintenance. In 1995, public shipyards will perform about 70 percent of NAVSEA's maintenance. Thus, if NAVSEA succeeds in reducing the capabilities of its shipyards to the core level, the share of ship maintenance done in the public sector will decrease.

NAVSEA's approach to the core method has some desirable features. It divides the command's peacetime maintenance between competing sectors without resorting to questionable assumptions about surge requirements and capabilities. It looks beyond military risk and considers economic risk by taking the extent of competition in the private sector into account.

Yet despite those merits, NAVSEA's approach cannot offer any insight into the public and private roles that might be appropriate in the long run. By allocating its workload largely on the basis of the current capabilities of the two sectors, NAVSEA begs the question of what capabilities each sector can and should maintain. Their current skills and facilities to a large degree reflect past Navy policies. The private sector, for example, will not develop or maintain the capability to undertake more overhauls of combatant ships than it expects to receive. A long-run strategy must consider not just the current structure of the industry but what it might become under different Navy policies.

Critics might also argue that NAVSEA's approach does not pay sufficient attention to the most likely risks in wartime. Although depot-level maintenance of ships will be of little importance during a conflict, a surge in the number of components needing repair would be expected. Today, private firms

4. Ibid.

5. NAVSEA identified large dry docks, the modernization and maintenance of complex combat systems, and nuclear ship fueling and refueling as capabilities available primarily in Navy shipyards. NAVSEA's concept of risk goes beyond the private sector's ability to provide high-quality, responsive support and takes into account the risk that the Navy might not get a competitive price because of a lack of competition in the private sector.

rather than Navy shipyards perform approximately 60 percent of the repairs on major components of Navy sea systems.[6] NAVSEA did not consider either public- or private-sector workloads for component repairs in calculating its core requirement. Yet in the current JCS scenario, a ready, responsive source of repair for the components essential to a service's warfighting mission may be more important than such a source for major platforms.

The Army

The Army based its core requirement on the labor force it would need to reconstitute its forces in the wake of two major regional conflicts, rather than on what it would need to maintain a ready force in peacetime or to sustain forces in wartime. Driving the Army's decision to focus on reconstitution was its recognition that its requirements for depot-level maintenance during regional conflicts would be quite limited.

The Army anticipates a selective surge in repairs at its depots during the transition to war as the depots finish work on end items that had been undergoing maintenance and fill supply pipelines by repairing components that had been in their backlogs. The depots would also help to sustain forces during the conflicts, focusing mainly on repairing components and meeting special requirements. Army depots would not increase their overall work schedules, however, until the first regional conflict had ended and worn and damaged equipment could be returned to the United States. The depots would then shift to a 60-hour work week for five months (a period that would extend past the end of the JCS scenario's second major regional conflict) to reconstitute a force adequate for a third regional contingency. Once that goal had been achieved, the depots would return to 40-hour work weeks until the force was totally reconstituted 12 months later. Most of the repairs would be done after both conflicts were over.

The Army determined its core capabilities with the above plan in mind. It started with the labor hours needed to carry out the repairs on mission-essential equipment that the JCS scenario would generate. Then it estimated what size workforce would be needed to accomplish those repairs over a 17-month period, working 60-hour weeks for five months and 40-hour weeks for 12 months. The Army's annual peacetime core requirement--the amount of maintenance that its depots must perform in peacetime to maintain core capabilities--is the number of annual labor hours that size workforce provides when working at peacetime rates.

The Army's peacetime core requirement is approximately 14 million direct labor hours per year, which is slightly greater than the number the service has programmed for its depots in 1999. Depending on the total level of funding for depot-level maintenance in 1999, the Army's need to keep approximately 14 million direct labor hours in its own depots could raise the public sector's share of maintenance above its current level.

One weakness of the Army's approach is its sensitivity to assumptions about the ability of public depots to provide a surge in labor hours and the time allowed for reconstitution. The Army could cut its peacetime core requirement almost in half by reconstituting the force in 24 months instead of 17 and requiring the depots to work 60-hour weeks for six months instead of five.[7] Arguably, the Army selected its assumptions because they yielded the "right" overall answer. That premise would be consistent with the way the service treated repairs on electronic equipment. When the initial list of mission-essential equipment yielded a small volume of such repairs, the Army modified the list to provide a more acceptable answer. (In calculating their core requirements, all of the services were aware that low estimates risked preempting decisions by their own senior managers about what, if any, depots to recommend for closure.)[8]

6. This figure is based on data for major components, such as engines and radars, whose maintenance is funded centrally within the Navy.

7. One reason that the Navy did not plan for a large surge in depot-level maintenance following a conflict is that it assumed a two-year period for reconstitution.

8. In some cases, the number and size of existing depots appear to determine what constitutes core workloads. In discussions with the Congressional Budget Office, Navy officials pointed out that decisions to close additional shipyards would reduce the amount of work that had to be included in the core requirement to spread overhead costs.

Another problem with the Army's core estimates is that even if the service assigned all of its peacetime maintenance to its own depots, it would be unable to maintain some of its core capabilities. Tanks and artillery require relatively modest amounts of maintenance in peacetime but could require extensive work after a conflict. As a result, the peacetime core requirements for tanks and self-propelled artillery are three and four times greater, respectively, than the Army's total peacetime maintenance requirements for that equipment.

The outcome is a mismatch: the total workload that the Army plans to assign to its depots in 1999 is close to the total peacetime core requirement, but the distribution of that work by broad commodity type (for example, ground combat vehicles, engines, and missiles) does not match the distribution of core requirements. In fact, only 61 percent of the Army's peacetime core requirement is matched by a planned workload for that same type of commodity. The Army could try to shift depot personnel with other skills into tank and artillery maintenance during reconstitution. But another--and arguably more practical--approach would be to call on the original equipment manufacturers and other private contractors to help in repairing those major end items.

The Army's effort to apply the core method points up the difficulties in using military risk to justify a dominant role for public depots in a scenario in which most of the needed maintenance comes in the aftermath of the conflict. Major end items that need only modest maintenance during regional conflicts drive the core requirement, rather than the repairs on components and special manufacturing that are most likely to demand rapid response in wartime. The core approach seems to provide detailed quantitative estimates that miss what really needs to be addressed.

The Air Force

Like the Army and the Navy, the Air Force calculated its core requirement under the assumption that it would need only a limited surge in maintenance during wartime. The Air Force expects the largest increase in repairs on major platforms to occur after the two regional conflicts are over. The total hours devoted to work on airframes would increase at the start of the conflict as depots either accelerated work schedules or omitted nonessential tasks to move out planes that had been undergoing maintenance. Because that surge would be both limited and brief, workloads for airframes would still be 67 percent below their levels in peacetime during the three-month period of the conflict in which those maintenance requirements would be at their peak.

In contrast, the Air Force expects that its repairs on engines and components during the conflicts would exceed their levels in peacetime. Engine repairs during the three months with the greatest requirements would rise to 121 percent of peacetime levels; component repairs would average 124 percent. Wartime requirements would vary dramatically by type of component, ranging from none (for components of training and simulation equipment) to more than twice peacetime levels (for instruments and components of oxygen equipment).

In determining its core requirements for repairs on engines and components, the Air Force followed the OSD method in a straightforward manner. It identified the repairs it expected to make on each type of engine and class of component, taking into account the number and types of planes involved in the JCS scenario and their expected sortie rates. It determined the peacetime core requirement based on the number of direct labor hours in peacetime that would permit the depots to meet the service's wartime needs for each type of component during the three months with the most expected repairs. (The Air Force assumed that during a conflict, its depots could operate at 1.6 times their peacetime level.)

Calculating the core requirement for repairs on airframes in that way would have justified keeping only 21 percent of the Air Force depots' current airframe workloads in the public sector. Perhaps because of that low figure, the service used a different procedure for airframes and determined a "readiness core" requirement. It took annual peacetime maintenance and modifications for aircraft required by the JCS scenario and divided them by a factor of 1.6 (the depots' potential surge in production during wartime). By using that approach, the Air Force produced a core requirement for airframes that was equal to 43 percent of its airframe maintenance in peacetime.

Those calculations yield a basic peacetime core requirement of 25 million direct labor hours. But the total requirement for the public depots rises to 29 million direct labor hours when the Air Force adds other work, including intermediate-level maintenance performed in its depots, maintenance from foreign military sales, work that is allocated to public depots based on public/private competitions, and work for which there is no private source (so-called last-source repair). Because the Air Force's core requirement is closely tied to the JCS scenario, the service expects the requirement to remain relatively constant in future years. However, the Air Force anticipates that by 1999, the share of maintenance done in the public sector will increase because that constant core requirement will be a larger portion of the Air Force's total workload of depot-level maintenance.

The way the Air Force has calculated its requirement appears to justify a major role for public depots over the long run, an outcome that is consistent with the service's traditional philosophy regarding maintenance. The treatment of maintenance for airframes, however, suggests that any process not yielding a result that agreed with the views of senior Air Force officials would have been replaced by a process that did. The core requirement for airframes--figured as the peacetime workload for the aircraft in the JCS scenario adjusted for the ability of depots to increase labor hours in wartime--does not translate into the size of labor force that the Air Force depots would need to perform peacetime maintenance while working a peacetime schedule or to perform wartime maintenance while working a wartime schedule. The Air Force may have adopted that arbitrary formula because it led to an estimate of core capabilities that, by itself, was judged acceptable.

It could be a mistake to conclude, however, that the Air Force's estimate of its core requirement is not a good one. The judgment of military leaders may be a more credible guide than mechanical calculations to the capabilities that DoD should maintain in its public depots. It seems, however, that the Air Force did not openly disclose the basis on which its estimate of the core requirement actually rests. If that is the case, the Congress has no way to evaluate the validity of that estimate.

The Air Force treats repairs on components somewhat inconsistently. As noted earlier, the private sector repairs some of the most sophisticated components of the services' frontline combat systems. But the Air Force's core requirement, like those of the other services, does not take into account mission-essential components that the private sector is currently repairing. The Air Force justifies such neglect by assuming that in wartime, firms in the private sector can surge to 1.5 times their rate of operations in peacetime. Yet by that criterion, almost all components could qualify for private-sector maintenance. The fundamental problem may be that the method for determining the core requirement does not emphasize costs. Therefore, DoD cannot use it to determine what repairs on mission-essential components should be left in the private sector for reasons of cost.

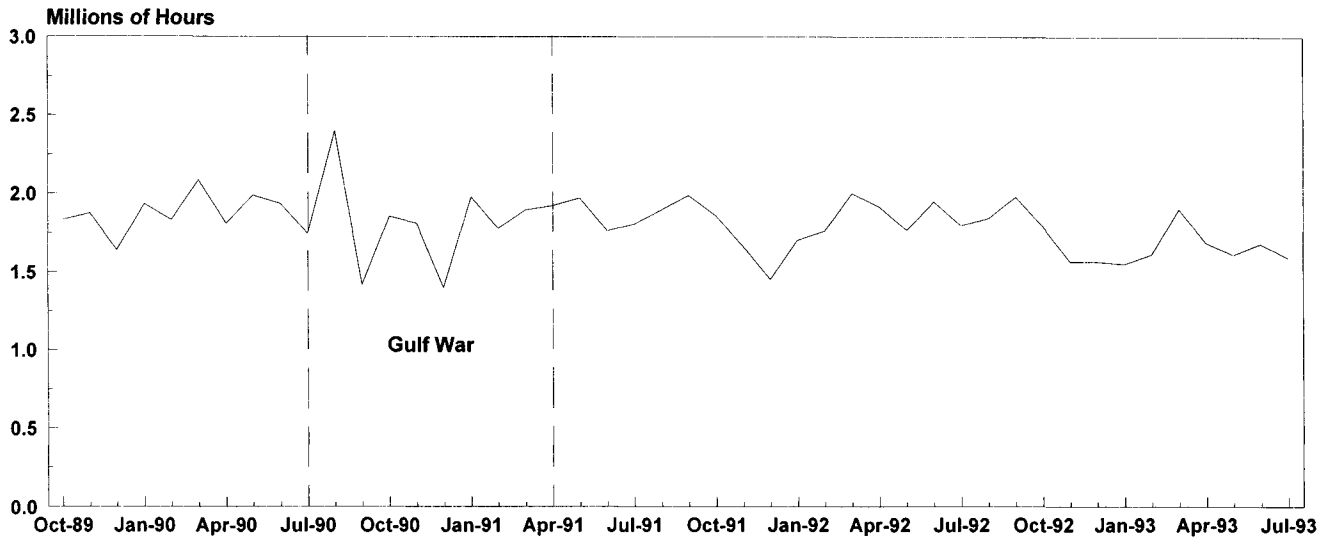
Naval Aviation

The Naval Aviation Systems Command (NAVAIR) also expects its maintenance on airframes to reach a peak (121 percent of the peacetime workload) after the major regional conflicts are over. However, the peak surge in maintenance on engines and components would occur during the conflict and would be substantially greater: 183 percent and 141 percent of peacetime workloads, respectively. Those estimates are consistent with the Navy's experience during the Gulf War, when a surge in the volume of engine maintenance caused some depots to expand operations (see Figure 4).

In retrospect, the Gulf War did not place heavy demands on the Navy's depots. But logistics managers at the time had no way of knowing how the conflict would develop, and they worked vigorously to fill pipelines. As a result, the way the depots responded during that conflict may be a reasonable guide to what more demanding scenarios would require.

Based on its experience in the Gulf War, NAVAIR estimated that its wartime workload would increase to 1.3 times its peacetime level. Consequently, the command calculated its wartime require-

Figure 4.
Workload in Navy Aviation Depots, October 1989 to July 1993 (In direct labor hours)



SOURCE: Congressional Budget Office based on data from the Navy used in John D. Keenan and others, *Issues Concerning Public and Private Provision of Depot Maintenance*, CRM 94-65 (Alexandria, Va.: Center for Naval Analyses, April 1994).

ment for maintaining the mission-essential airframes, engines, and components needed to support the JCS scenario by multiplying the peacetime maintenance for that equipment by a uniform workload adjustment factor of 1.3. (In reality, however, increases in workloads would differ by type of equipment.) NAVAIR determined the basic peacetime core requirement by dividing its wartime requirement by 1.6 (the assumed surge in labor hours provided by naval aviation depots in wartime). That calculation yielded a basic peacetime core requirement of approximately 8 million direct labor hours.

Unlike the Air Force, the Navy did not make a special allowance for a core requirement for airframe "readiness." However, it did add hours to its basic peacetime core requirement to bring small core workloads up to a size that the public depots could handle economically, to permit modifications and routine overhauls to be done concurrently, and to avoid sending uneconomically small noncore workloads to the private sector. For NAVAIR as a whole, those adjustments make up a large share of the total public requirement of 13 million direct labor hours. (The Air Force's adjustments were smaller because it assumed that the ability to work on one type of airframe or on one component within a commodity group translated into the ability to work on others. The Navy made a different assumption: if the JCS scenario called for a single E-2/C-2 aircraft, the service saw that as a requirement to maintain an economical workload for that aircraft in the public depots.)

The relationship between NAVAIR's estimated core requirement and the amount of work that the Navy actually plans to perform in its depots is unclear. According to DoD's most recently published plans, NAVAIR will devote approximately $1.2 billion to depot-level maintenance in 1999.[9] The Navy's own depots, which will perform approximately 9.5 million direct labor hours of maintenance, will receive about two-thirds of that total--less than the share they currently receive. Apparently, the Navy plans to reduce the proportion of work going to the public sector even though public workloads will be well below the service's core level.

9. Defense Depot Maintenance Council, *Business Plan for Fiscal Years 1995-1999* (February 1995).

What Are the Weaknesses of the Core Concept?

Finding inconsistencies and logical problems in the core calculations that each service uses is not difficult. Some of them are relatively minor matters that OSD could resolve through better guidance. But many of the difficulties that the services encountered in applying the OSD method reflect fundamental flaws in the core concept itself. As the Army's estimates show, the assumption that DoD cannot rely on the private sector to repair frontline systems lacks credibility when it is applied to maintenance requirements that will not emerge until a conflict is over.

Another fundamental problem is that trade-offs between the risk entailed in using private-sector contractors and the lower costs that such use makes possible are frequently necessary even for repairs on essential equipment. (That the services make such trade-offs is evidenced in the private sector's repair of components for mission-essential end items whose routine maintenance is kept in the public sector.) But because the DoD core concept does not consider costs and does not differentiate between degrees of risk, it cannot guide the services in making those trade-offs. Instead, the OSD method defines all items that are repaired in the private sector as noncore. Thus, even though repairs on components will account for much of the surge in depot-level maintenance during regional conflicts, the Navy, the Army, and the Air Force did not examine the extent to which they rely on the private sector for such repairs.

The core concept thus continues DoD's traditional emphasis on risk as the rationale for maintaining public depots. But some logistics managers--including some Air Force managers--suggest that cost should play a significant part in determining public and private roles in the post-Cold War era. Even if DoD cannot justify a dominant role for public depots on the basis of risk, it may be able to argue for one based on cost-effectiveness in peacetime. Moreover, if the cost of achieving required levels of quality and output is the criterion for allocating maintenance work to the two sectors, DoD might be able to rely on competition between public and private facilities to divide its workload fairly and efficiently. Those arguments deserve careful examination, but first, it is useful to review what economists and political scientists say in general about the different characteristics of public and private production.

Chapter Four

Characteristics of Public and Private Production

A well-established body of literature in the fields of economics and political science describes the different characteristics of producers in the public and private sectors and how those characteristics typically affect performance in different situations. That literature cannot answer questions about the relative costs and benefits of public or private maintenance for any particular depot-level task. But it can provide a conceptual framework for evaluating the conflicting claims made by advocates of public depots and industry lobbyists.

Goals and Constraints in Public Production

Definitions of public, private, and mixed modes of production focus on whether the government owns the capital (for example, facilities and equipment) that is being used and whether managers and workers are employees of the state. The mode of production matters because differences in type of ownership, management, and labor typically imply differences in goals and constraints and thus in performance.[1]

Through the political process and the government's ability to tax, public producers have access to resources that are not derived from the sale of goods to customers in an open market. Those resources allow public producers to adopt goals other than maximizing profits and minimizing costs, which are required for firms to survive in a competitive market. At the same time, the dependence of public managers on the political process for investment funds and other resources constrains their ability to organize production efficiently.

Of course, large corporations in markets with a limited amount of competition are also free to adopt other goals. Such firms must also rely on internal administrative controls rather than on markets to organize the various stages of production. Ultimately, however, a firm's dependence on revenue from sales of its products restricts the degree of freedom enjoyed even by a monopolist in the private sector.

The goals that public producers pursue reflect both the political environment on which the producer's survival depends and the producer's own organizational culture. Among the goals that are frequently identified with public producers are the following:

- Providing the highest quality of output
- Supplying the greatest level of output
- Obtaining the most modern technologies
- Being fair to suppliers, workers, and customers
- Offering continuity of employment to workers

1. For a summary of the strengths and weaknesses of market and nonmarket production, see Charles Wolf Jr., *Markets or Governments: Choosing Between Imperfect Alternatives* (Cambridge, Mass.: MIT Press, 1988).

- Supporting suppliers who may be small or disadvantaged businesses[2]

Many of those goals relate to issues of fairness. In comparison, minimizing the cost of producing a given quantity and quality of output may not have high priority for public producers, although it may be a goal. In the U.S. political environment, diverse, competing interest groups all have a voice, and according to some observers, no decision is ever final. In such circumstances, a public manager's need to show that decisions were made in a fair, nonarbitrary manner (following standard operating procedures and preestablished rules) frequently takes precedence over efforts to organize production in the most cost-effective manner.

Despite its simplicity, this view of public organizations helps to explain many of the traits typically associated with public production. It may, for example, help to account for civil service regulations that ensure fairness for job applicants and employees, and procurement practices that focus on the lowest bidder (rather than on judgments about the past performance of potential contractors, which might appear arbitrary).[3] In the case of depot-level maintenance, it could explain policies for rotating depot commanders to other positions to ensure equitable treatment at the cost of job continuity, and the use of formal processes (such as the method for determining core requirements) for justifying outcomes. Standard rules and operating procedures help to promote accountability in a sector in which market discipline is largely absent.

Public producers may be subject to reforms that are designed to make them behave more like private producers. Yet the distinctive characteristics of public production are likely to resist change to the extent that they reflect the political constraints and incentives facing the organization. One study of the federal procurement system found that contracting officers tended to award contracts based on price, a readily quantifiable and easily justified factor, even when they had the authority to use discretion and take past performance into account.[4]

In the case of depot-level maintenance, the Department of Defense has for decades tried to make public producers more businesslike through a revolving fund that requires customers of the depots to use appropriated funds to "buy" the depots' services (see Box 2 on pages 28 and 29). That approach can encourage more awareness of costs among both producers and users of those services. Yet as long as the political process imposes other goals (such as keeping specific depots operating or keeping a specified level of work at a depot) and as long as higher costs for depot-level maintenance lead to additional funding for customers, public depots are unlikely to focus as intently on using resources efficiently as do private firms in competitive markets.

In addition, there may be a limit on the extent to which it is desirable to make public facilities more businesslike. A publicly owned enterprise that is forced to compete against private producers on a level playing field might survive by behaving like a private firm and focusing on the efficient use of resources.[5] But efforts to make public producers behave exactly like private firms would, if successful, eliminate the advantages of public production as well as its disadvantages.

2. Some of those goals are addressed in Wolf, *Markets or Governments*, pp. 70-77.

3. James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989), p. 127.

4. Steven Kelman, *Procurement and Public Management* (Washington, D.C.: AEI Press, 1990), p. 125.

5. Evidence on this point is relatively limited, however. See Anthony E. Boardman and Aidan R. Vining, "Ownership and Performance in Competitive Environments: A Comparison of the Performance of Private, Mixed, and State-Owned Enterprises," *Journal of Law and Economics*, vol. 32 (April 1989). A government-owned enterprise whose behavior and survival depend solely on market forces is not an impossibility, but in the United States, government ownership of large enterprises is inextricably combined with political support. In situations in which the government has forced small groups of public employees who provide commercial activities to compete for survival (as in competitions managed under the Office of Management and Budget's Circular A-76), the result has been significant reductions in costs.

The Government's Make-or-Buy Decision

Despite what some analysts have termed the "special disabilities" of public enterprises, public or mixed forms of public/private production in some cases may be more cost-effective than private production. Of particular interest for this study are situations in which it is more cost-effective for the government to produce goods and services (such as depot-level maintenance) for its own use than to purchase them from private producers.

In some respects, the government is like any private firm facing a make-or-buy decision. Several factors may cause it to choose to perform work in-house: the cost of setting up and monitoring contracts is high relative to the actual cost of production (as is the case if quality or quantity of output is hard to measure objectively or if continual renegotiations are necessary to meet changing requirements); workloads are large enough so that the in-house producer can take advantage of economies of scale; and the work can be done for the least cost by using highly specialized capital and labor for which there are neither alternative sources nor uses.[6] Generally, small, erratic workloads for which outputs are ill-defined, or for which the quality of the work cannot be determined except by monitoring the process used to do it, are not well-suited to contracts.

Yet some important differences exist between the make-or-buy decisions of public and private producers. One difference is that the decision of public producers to contract for work usually shifts production from the public to the private sector. To the degree that private suppliers have both greater freedom and stronger incentives to use resources efficiently, contracting can be a particularly cost-effective alternative for public producers.

6. The relevance of these factors to DoD's decisions about depot-level maintenance is noted by Frank Camm, *DoD Should Maintain Both Organic and Contract Sources for Depot-Level Logistics Services*, RAND Issue Paper (Santa Monica, Calif.: RAND, August 1993). Oliver E. Williamson provides a more technical discussion of how these factors affect the way in which private firms organize production. See Williamson, *The Economic Institutions of Capitalism* (New York: Free Press, 1985).

The Private Sector's Ability to Produce at Low Cost

A large body of empirical evidence suggests that production by the private sector is less costly than public production if competition is possible among private producers. One review of 50 studies that compared public and private production found that in 40 of them, private production was less costly.[7] (Seven studies yielded ambiguous results, and three concluded that public production was less costly.) The 50 studies covered a wide range of fields including airlines, banking, bus services, fire protection, repairs of ocean tankers, housing, hospitals, refuse collection, and water and electric utilities. In those studies that provided estimates of the magnitude of savings, the difference in costs between the public and private sectors generally ranged from 20 percent to 40 percent.

Explanations of the private sector's advantage in production frequently point to better management and lower labor costs, both of which might in turn be attributed to the effects of competition.[8] In markets in which competition among private producers is not possible, little evidence can be found that shifting production from the public to the private sector yields significant savings.[9] The difference in costs typically found for public and private enterprises stems from differences in constraints and goals and not necessarily from ownership as such. The general literature on public and private production suggests that DoD should not expect to gain significant savings in its costs for depot-level maintenance from shifting work to the private sector unless competition exists among private firms for that work.

7. Thomas E. Borcherding, Werner W. Pommerehne, and Friedrich Schneider, *Comparing the Efficiency of Private and Public Production: The Evidence from Five Countries* (Zurich: Institute for Empirical Research in Economics, University of Zurich, 1982), as cited in Wolf, *Markets or Governments*.

8. Wilson, *Bureaucracy*, p. 351.

9. See John Vickers and George Yarrow, "Economic Perspectives on Privatization," *Journal of Economic Perspectives*, vol. 5, no. 2 (1991), pp. 111-132.

Box 2.
Strengths and Weaknesses of Public, Private, and Mixed Modes of Production If the Government Is the Customer

Although it is sometimes convenient to speak of the choice between public and private modes of production, a number of mixed forms include aspects of both the public and private alternatives. Each mode has its particular strengths and weaknesses. Outlined below are some of the characteristics that the government should consider in deciding which mode to adopt.

Private Production. In this mode, plant and equipment are privately owned, and managers representing the owner's interests hire and direct the labor force. Private production can be a cost-effective source of goods and services for the government if more than one firm competes for a contract and the cost of administering the contract and monitoring the contractor's performance is not excessive. Those conditions are usually met when the government purchases goods and services that are commercially available. However, tasks that require unique or highly specialized capital, labor, or knowledge can inhibit competition. Contracting can be costly or ineffective in ensuring adequate performance of work whose requirements are subject to frequent and sudden change or for which the government cannot clearly specify the quality of the output.

Private Production with Leased Assets. In this case, private producers work in their own facilities using specialized equipment that they lease from the government. That mode is likely to be a cost-effective alternative if the need for specialized equipment is the only obstacle to competitive private production. Private production with leased assets allows competition even for tasks that require unique equipment, provided that the equipment is mobile and the task does not require unique skills and knowledge (so that multiple contractors are able to bid in recompetitions for future contracts). However, it may not be appropriate for the government to supply general industrial equipment to private producers. Because the government's investment decisions depend on factors other than market forces, the government may not maintain the most cost-effective mix of equipment.

Production in Government-Owned/Contractor-Operated Facilities (GOCOs). Private firms may use their own labor, material, and management to produce goods and services for the government in government-owned facilities. Because that alternative depends on the political process rather than market forces to determine the number and types of facilities used, it can result in an inefficient industrial base. Nonetheless, if the contract for managing the GOCO is put out for recompetition periodically, such an approach can encourage the efficient use of labor and material. It may be cost-effective in cases that require highly specialized assets that are immobile. However, it could prove more costly than public production in situations in which only one contractor has the labor force and knowledge to operate a particular facility.

Production by a Regulated Monopoly. Typically, regulated monopolies are privately owned enterprises that have a monopoly franchise and are subject to legal regulations governing price, output, or profit. The government can use that approach as an alternative to public production if private production, because of economies of scale and the need for specialized resources, would lead to an unregulated monopoly.

Because regulation may limit the incentive of producers to produce for the least cost, this alternative is not attractive in situations in which competition would be possible. Nonetheless, regulated monopolies may have greater freedom than public enterprises to organize production efficiently. (Regulated monopolies, for example, can obtain capital in the private sector--rather than through the political process--and do not

The Public Sector's Inability to Contract Efficiently

The other difference between the make-or-buy decisions of public and private producers is that the same characteristics that make it hard for public producers to use resources efficiently also make it difficult for them to contract for goods and services. Public enterprises should choose to buy inputs more often than private enterprises do only if the government's disad-

need to abide by the same personnel policies as public employers.) A GOCO or a regulated monopoly that serves the government might be more likely than a purely private producer to have a long-term relationship with its customers. With such a relationship, the risk might be less that a GOCO or regulated monopoly would not respond to government needs in an emergency.

Nominally, most firms that specialize in producing goods and services for the military are privately owned. But those that use highly specialized capital and labor to produce something that only the Department of Defense (DoD) purchases share many of the characteristics of a GOCO or a regulated monopoly (including a long-term relationship with their customer or regulator). The government, for example, has both the ability and the desire to ensure that the Newport News Shipyard (now the only facility in the United States with the necessary skills and assets to construct nuclear aircraft carriers) earns a reasonable--but not excessive--rate of return on its investment.

Production by a Government Corporation. Government corporations are partially or wholly owned by the government, but they generally budget and operate more like private firms than like government agencies. Although their characteristics vary widely, in many instances they are free to follow private-sector employment policies, borrow in private credit markets, and set prices for their products based on market factors. Examples of government corporations include Amtrak and the Tennessee Valley Authority.

Government corporations commonly differ from private firms in several respects: their charters can specify goals other than earning the largest possible profits, they may be at least partially dependent on appropriated funds for their survival, and they are frequently subject to political pressures. Those features can reduce their ability and need to use resources efficiently. Yet such corporations offer the government the greatest degree of direct control short of public production. Moreover, their quasi-governmental status can protect them from some of the risks--such as strikes and bankruptcy--that purely private firms face.

Public Production. This mode of production occurs in a government-owned facility with a labor force that is employed directly by the government and is subject to the same rules and regulations that apply to other public employees. Managers typically depend on the appropriation process for resources. When the producer and the consumer are part of the same agency, public production allows direct control, without the need for negotiations or a contract. Public production can be useful in situations in which the agency's role in production provides it with indirect benefits (such as knowledge about the product) and contracts would be costly or ineffective. (For example, contracts are difficult to use if the government cannot easily specify the level and quality of output it requires or if the needed outputs change frequently and renegotiating contracts would inhibit timeliness.) Many of the situations in which public production is appropriate are those in which the government cannot effectively use competition among multiple producers, with its potential for reducing costs.

Revolving funds, such as the one that DoD currently uses for depot-level maintenance, incorporate some of the features of a government corporation and some of the features of conventional public production. Like a government corporation, the producer operating through a revolving fund prices its outputs and relies primarily on revenues from sales to cover the cost of production. But despite that businesslike feature, revolving funds resemble conventional public production because they rely on labor employed directly by the government and are unable to borrow in private credit markets. Moreover, in the case of the revolving fund that supports depot-level maintenance, both the producers and users of the maintenance services are ultimately part of the same agency (DoD). As a result, the relationship between customer and buyer goes beyond the merely contractual.

vantage in production outweighs its disadvantage in contracting.

In the defense area, some experts estimate that contracting, evaluation, and enforcement absorb between 20 percent and 40 percent of all procurement spending.[10] (One study found that the process of competitive source selection absorbed from 5 percent to 10 percent of a program's total costs before any

10. John D. Donahue, *The Privatization Decision* (New York: Basic Books, 1989), p. 109.

production was undertaken.)[11] The costs of contracting are likely to be greatest for contracts to develop or produce new weapon systems; they are likely to be less for purchasing goods and services that are commercially available or for purchasing the same goods and services repeatedly, which allows standard contracts to be used. Estimates by the Navy, based on data from public/private competitions, indicate that the cost of contracting for depot-level maintenance for aviation systems ranges from 3 percent to 5 percent of the value of the contract.[12] The accounting firm Coopers & Lybrand suggests that it cost DoD approximately $4.3 million to conduct a competition for the $62 million contract to replace the center wing box on C-141 aircraft.[13]

The government's contracting practices, in addition to being more costly than contracting practices in the private sector, may also discourage the long-term relationships that encourage suppliers to respond quickly to, and in some cases anticipate, the needs of their private customers. The appropriate mix of public and private production in both depot-level maintenance and other areas is likely to depend in part on the success of efforts to reform the federal procurement system.

Choosing Among Public, Private, and Mixed Alternatives

The current economics literature emphasizes that the choice between in-house and contract sources of production is a choice between imperfect alternatives.[14] In some cases, the least imperfect solution is one that combines elements of both public and private production. For example, if the only factor limiting competition was the need for specialized equipment, the government might lease the equipment to private producers. Other mixed arrangements include government-owned/contractor-operated facilities, regulated monopolies, and government corporations (see Box 2).

It is not possible to determine solely on the basis of conceptual arguments whether in-house public production, a contract with a private firm, or some mixed arrangement is the least imperfect alternative for any particular maintenance task at the depot level. It is possible, however, to identify some of the factors that DoD needs to consider in allocating workloads to public, private, and mixed facilities.

Attractive candidates for private-sector contracts might include workloads for which DoD could develop and use standard contracts, for which outputs would be easy to evaluate, or for which competition in the private sector was possible. Other workloads for which contracting might reduce costs include those that private firms can combine with either new production or with commercial repair work. The difference between the costs of in-house and contract alternatives will vary widely depending on the specific task. Nevertheless, a difference of 20 percent (net of contracting expenses) over the long run for workloads with the above characteristics would not be inconsistent with the general empirical literature that compares public and private production.[15]

DoD could try to analyze its workloads in terms of those characteristics and then allocate them on that basis to either a public, private, or mixed producer. That approach would have a stronger conceptual foundation than the mechanical core calculations that the department has adopted. Such analyses would, however, be difficult to conduct. Moreover, they would involve subjective judgments that could leave their results open to challenge. Might not direct competition between public and private producers be a much simpler and at least equally fair and effective way to determine which sector was best suited for which workload?

11. Ibid.

12. John D. Keenan and others, *Issues Concerning Public and Private Provision of Depot Maintenance*, CRM 94-65 (Alexandria, Va.: Center for Naval Analyses, April 1994), p. 23.

13. Coopers & Lybrand, *Preliminary Case Studies of Public Versus Private Competition* (Washington, D.C.: Coopers & Lybrand, July 1994), p. 4.

14. Williamson, *Economic Institutions of Capitalism*.

15. Keenan and others, *Issues*, p. 23, and Donahue, *The Privatization Decision*, p. 216.